REMARKS

Claim 32 has been amended and claims 44-91 have been added leaving claims 1-91 pending in the application.

Applicant's remarks below are preceded by quotations of the related comments of the Examiner in small, boldface type.

> **2. Claims 1, 5, 7-10, 19, 23, 25-28, 36, 37, 40, and 41 are rejected under 35 U.S.C. 102(b) as being anticipated by Steigerwald et al. (US 5,274,539).**
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> **Steigerwald et al. discloses a power distributing apparatus comprising a first regulator (30), a bus, and voltage transformation modules (20, see any of figures 4 or 6-9) including switch (Qa and Qb), transformers (T1 and T2), and rectifiers (Sra and SRb).**
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> **3. Claims 2, 17, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.**
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> **Steigerwald et al. teaches a power distributing apparatus as recited by claims 2, 17, and 20 except for specifying that the voltage transformation module has a conversion efficiency greater than 80%. Voltage transformation modules having a conversion efficiency greater than 80% were well known and old in the art at the time of the invention. It would have been obvious to one of ordinary skill in the art at the time of the invention to have constructed the power distributing apparatus of Steigerwald et al. to have any desired conversion efficiency known and old in the art, such as greater than 80%, since this is part and parcel of the normal process of making a specific power supply for a specific purpose.**
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> **4. Claims 3 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.**
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> **Steigerwald et al. teaches a power distributing apparatus as recited by claims 3 and 21 except for specifying that the primary switches operate in a series of operating cycles characterized y power transfer and energy recycling intervals. Operating the primary switches of a power distributing apparatus in a series of operating cycles characterized by power transfer and energy recycling intervals was an old and known expedient in the at the time of the invention that increases the conversion efficiency. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the power distributing apparatus of Steigerwald et al. by operating the primary switches in a series of operating cycles characterized by power transfer and energy recycling intervals in order to increase the conversion efficiency.**
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> **5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.**
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> **Steigerwald et al. teaches a power distributing apparatus as recited by claim 4 except for specifying that the voltage transformation module operates at or above 500 KHz. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the power distributing apparatus of Steigerwald et al. by specifying that the voltage transformation module operates at or above 500 KHz since it has been held that where the general conditions of the claimed invention are disclosed in the prior art discovering the optimum or workable ranges of result effective variables involves only routine skill in the art.**

Applicant respectfully disagrees. The above rejections overlook a critical difference between applicant's claims and the cited art. First, applicant's claims are directed to a new power distribution architecture called the Factorized Power Architecture ("FPA"). The

Factorized Power Architecture makes available increased system density as well as other advantages discussed extensively in the specification beginning at page 18, line 14. Some of the benefits of the Factorized Power Architecture include: (1) less mounting area is required ***leaving more board area for electronic circuitry,*** (2) lower power dissipation ***eases cooling requirements,*** (3) lower height (a) offers less interference to airflow ***easing thermal management*** and (b) allows an increased pitch of PCB subassemblies increasing system density, and (4) sources of heat may be removed from the point of load. See, spec. p. 21, lines 11-23; Figs. 3-5.

In the Factorized Power Architecture, the regulation and voltage transformation functions are separated. This separation is defined in various ways in the claims, for example, as ***separated by a distance***, ***factorized away***, or ***packaged separately.*** Independent method claims 1-4 and 89 and independent apparatus claims 19-21 recite, in one form or another, that the regulation and voltage transformation functions are ***separated by a distance.*** Claims 1-3 recite "using the factorized bus to carry power from the first regulator to a remote location ***separated by a distance*** from the first location." Likewise, added claim 89 recites, "using the factorized bus to carry power from the first regulator to the input of a voltage transformation module ("VTM") on the load assembly, wherein the first regulator is ***separated by a distance*** from the VTM." Claims 19, 20, and 21 recite "a factorized bus connected to the first output of the first regulator and extending to a remote location ***separated by a distance*** from the first location." Claim 4 recites "***factorizing away from the point-of-load*** a power converter function of ***voltage regulation***...[and] ***localizing at the point-of-load*** a function of ***DC voltage transformation.***"

Added independent method claims 76, 81, 89, 90, and 91 recite, in one form or another, that the voltage transformation function is ***packaged separately from*** the regulation function. Claim 76 recites "***packaging the voltage control physically separate from the VTM package.***" Similarly, claim 81, recites "wherein the utilization of switch and magnetic components in the power train is increased by ***excluding the regulation from the VTM package.***" Claim 90 recites "the VTM being housed within a VTM enclosure and located on the load assembly, ***wherein the first regulator is outside of the VTM enclosure.***" Similarly, claim 91 recites "***the VTM is***

enclosed in a package that excludes the first regulator." In one way or another, therefore, the above claims define the "separation."

Applicant's architectural approach (FPA's "separation") proceeds contrary to the accepted practice of the industry to combine voltage regulation and transformation. Applicant discusses the advantages and disadvantages of power distribution architectures, including the centralized power architecture ("CPA") (p. 2, line 23 to p. 3, line 1), distributed power architecture ("DPA") (p. 3, lines 1-18), and the intermediate bus architecture ("IBA") (p. 5, line 27 – p. 6, line 3) as well as others (p. 5, line 22 – p. 6, line 3). The DPA combines voltage transformation and regulation in DC to DC converters placed near the point of load. The CPA also combines these functions, but, does so away from the point of load. Recently introduced architectures, such as the IBA, place regulation at the point of load. The claimed "separation" is therefore contrary to the accepted "wisdom."

The Steigerwald patent is directed at supplying power to pulsed loads, more specifically radar transmitters. Col. 1, lines 6-7. The solution presented in the Steigerwald patent is a new converter called a capacitance multiplying converter ("CMC") 20. Energy storage capacitors are connected to the input, high voltage, side of the capacitance multiplying converters. Fig. 4; Col. 3, lines 34-38. According to the description, the energy storage capacitor is always transformer coupled to the output through one or the other of the paralleled switch-transformer power trains. The Steigerwald patent appears to place great emphasis on this constant connectivity. *See,* col. 3, lines 31-39. combined with a standard pre-regulator 30. Fig. 4; Col. 4, lines 6-10. In one embodiment, the Steigerwald patent shows several CMCs 20 being supplied by a single pre-regulator 30. Fig. 5; Col. 4, lines 28-37.

In contrast to applicant's claims, the Steigerwald patent does not teach anything about separating the pre-regulator from the capacitance multiplying converter, let alone the desirability of separation by a distance. Steigerwald does not teach anything about packaging let alone packaging the CMC so the pre-regulator is physically separate, separately packaged, or excluded from the CMC. In fact the Steigerwald patent teaches away from the claimed separation by including in Fig. 6 a gate drive circuit 40' that is common to both of the pre-regulator 30' and the

CMC 20. Fig. 6 clearly demonstrates that the pre-regulator and CMC are to be kept together and in the same package. The Steigerwald patent therefore teaches away from the claimed separation.

Furthermore, the Steigerwald patent does not mention anything about placing the CMC at the point-of-load, let alone factorizing the pre-regulator away from the CMC or the point-of-load. To the contrary, the use of arrows pointing to the pulse loads in Fig. 5 implies that the pre-regulator and the CMC (which are close together as shown in Fig. 6) are located away from the pulse loads.

In summary, the Steigerwald patent simply fails to teach or suggest anything about ***separating by a distance, separately packaging, or factorizing away*** the regulation and voltage transformation functions as claimed. Claims 1-4, 19-21, 76, 81, 89, 90, and 91 are patentable for at least these reasons.

Other features of the FPA are recited in the remaining independent claims. The scalability feature found, for example, in some FPA embodiments is also claimed. Independent method claim 5 and independent apparatus claim 23 require, in one form or another, a power sharing array of VTMs. Claim 5, requires "***operating two or more*** voltage transformation modules ("VTMs), each comprising a transformer and an output resistance R_{out}, ***in parallel*** to convert power, via the transformers, from an input voltage, V_{in}, essentially equal to the factorized bus voltage, V_f, to a DC output voltage, V_{out} ... wherein the ***power*** provided to the load is ***shared in inverse proportion to the output resistance*** by each of the VTMs." Similarly, claim 23 requires, among other things, "***two or more*** voltage transformation modules ("VTMs") ***connected in parallel***, each VTM having ... a transformer ... [and] an output resistance, R_{out}; wherein the ***power*** delivered to the load is ***shared*** by each VTM ***in inverse proportion to the output resistance*** of each VTM."

The Steigerwald patent shows several CMCs 20 connected to a single pre-regulator 30 in Fig. 5. However, the Steigerwald patent does not even mention load sharing, let alone whether it is desirable or possible to connect the capacitance multiplying converters together in parallel to supply a load. Claims 5 and 23 are patentable for at least this reason.

Similarly, added independent method claim 85 recites "a method of distributing power to a plurality of loads each having a respective DC voltage level and tolerance requirements, comprising: ***unifying power distribution requirements*** *using a plurality of VTMs to transform the respective DC voltage level requirements* ***into a common voltage level***; distributing power at the common voltage level to the VTMs for delivery to the loads; and controlling the unified voltage to satisfy DC voltage tolerances of the plurality of loads."

Although the Steigerwald patent shows several CMCs 20 in Fig. 5, there is no mention of unifying different load voltage requirements. In fact, only one load voltage (from 5 or 6 to 9 Volts for a radar load) is mentioned in Steigerwald. Col. 1, line 21; Col.3, lines 3-4, 50. The logical conclusion, is that Steigerwald's pulse loads in Fig. 5 are all the same and require the same voltage. Steigerwald simply does not teach or suggest "***unifying power distribution requirements*** *using a plurality of VTMs to transform the respective DC voltage level requirements* ***into a common voltage level***" as claimed and in fact teaches away from it describing a single load voltage. Claim 85 is patentable for at least this reason.

Finally, added independent method claim 86 recites, among other things, "a method of distributing power in a system comprising: providing a first point-of-load ("POL") converter to convert power received from a bus over a normal operating input voltage range for delivery to a first load at a first load voltage [and] ***enhancing a power density of the first POL converter by optimizing the first POL converter for a predetermined fixed input voltage.***" Although the Steigerwald patent does disclose several CMC embodiments, applicant's review of that patent found not even a single mention of how to, or even that it might be desirable to, enhance the power density of the CMC, let alone the claimed optimizing for a predetermined fixed input voltage. The Steigerwald patent therefore fails to teach or suggest "***enhancing a power density of the first POL converter by optimizing the first POL converter for a predetermined fixed input voltage***" as claimed. Claim 86 is patentable for at least these reasons.

6. Claims 6, 11, 15, 16, 24, 29, 34, 35, 42, and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al. teaches a power distributing apparatus as recited by claims 6, 1, 15, 16, 24, 29, 34, 35, 42, and 43 except for controlling the bus voltage using a load voltage feedback signal. Controlling the bus voltage provided by a pre-regulator using

a load voltage feedback signal was an old and known expedient in the art at the time of the invention. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the power distributing apparatus of Steigerwald et al. by controlling the bus voltage using a load voltage feedback signal in order to move the regulation of the output voltage back to a previous conversion stage.

Applicant respectfully disagrees. Dependent claims 6, 11, 15, 16, 24, 29, 34, 35, 42, and 43 depend from and incorporate the features of independent claims 1 and 19 discussed above and are therefore patentable for at least the same reasons.

7. Claims 12-14 and 30-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al. teaches a power distributing apparatus as recited by claims 12-14 and 30-32 except for utilizing either input or output switches to protect against voltage transformation module or bus faults. Utilizing input or output switches to protect against voltage faults were old and known expedient in the art at the time of the invention. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the power distributing apparatus of Steigerwald et al. by utilizing input or output switches in order to protect against voltage transformation module or bus faults.

Applicant respectfully disagrees. Dependent claims 12-14 and 30-32 depend from and incorporate the features of independent claims 1 and 19 discussed above and are therefore patentable for at least the same reasons.

8. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al. in view of Kajouke et al. (US 6,154,381).

Steigerwald et al. teaches a power distributing apparatus as recited by claim 18 except for utilizing the power distributing apparatus in a vehicle. Kajouke et al. teaches utilizing a power distributing apparatus in a vehicle was an old and known expedient in the art at the time of the invention. It would have been obvious to one of ordinary skill in the art at the time of the invention. It would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the power distributing apparatus of Steigerwald et al. by utilizing in a vehicle order as the necessary power distributing apparatus.

Applicant respectfully disagrees with the above characterization of the Steigerwald and Kajouke patents. Steigerwald does not teach or suggest separating the voltage regulation by a distance from voltage transformation as discussed above. Kajouke doesn't either. In fact Kajouke's use of a centralized power regulator for the vehicle and failure to mention using VTMs, teach away from the pending claims. (The adaptive switching of power modules in and out of the circuit to maximize efficiency is not relevant to applicant's claims.) Because

individually the reference fail to teach or suggest the claimed "separation" the combination also fails to do so.

Claim 18 depends from and incorporates the features of independent claim 1 discussed above and is therefore patentable for at least the same reasons.

> **9. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.**
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> **Steigerwald et al. teaches a power distributing apparatus as recited by claim 22 except for specifying that the primary switches operate in a series of operating cycles characterized by power transfer and energy recycling intervals, have a period less than 2 microseconds, and that the voltage transformation modules have a power density greater than 250 Watts/ci. Operating the primary switches of a power distributing apparatus in a series of operating cycles characterized by power transfer and energy recycling intervals was an old and known expedient in the art at the time of the invention that increases the conversion efficiency. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the power distributing apparatus of Steigerwald et al. by operating the primary switches in a series of operating cycles characterized by power transfer and energy recycling intervals in order to increase the conversion efficiency and it would have been obvious ton one or ordinary skill in the art at the time of the invention to have modified the power distributing apparatus of Steigerwald et al. by utilizing a period less than 2 microseconds, and a power density greater than 250 Watts/ci since it has been held that where the general conditions of the claimed invention are disclosed in the prior art discovering the optimum or workable ranges of result effective variables involves only routine skill in the art.**

Applicant respectfully disagrees. Another variation of the "separation" discussed above is presented in claim 22 which requires, among other things, "a voltage transformation module ("***VTM***") ***having an enclosure*** for housing power conversion circuitry, ***an input terminal,*** and ***an output terminal***; ... a transformer; two or more primary switches connected to ***drive the transformer with power received from the input***; ... ***wherein the VTM has ... an essentially constant DC voltage gain, $K = V_{out}/V_{in}$,*** at a load current, ... ***and regulates the load voltage, V_{load}, as a fraction, K, of the factorized bus voltage, V_f.***"

Claim 22 does not expressly state that the VTM excludes the regulation function. However, claim 22 does state that the module has input and output terminals and an essentially constant voltage gain and it regulates the load voltage as a fraction of the factorized voltage. These features combine to exclude voltage regulation from the VTM of claim 22. As discussed above, the Steigerwald patent fails to teach or suggest and in fact teaches away from the claimed separation. Claim 22 is patentable for at least this reason.

10. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al. teaches a power distributing apparatus as recited by claim 33 except for specifying that the duty cycle of the voltage transformation module is greater than 90%. Voltage transformation modules having a duty cycle greater than 90% were well known and old in the art at the time of the invention. It would have been obvious to one of ordinary skill in the art at the time of the invention. To have constructed the power distributing apparatus of Steigerwald et al. to have any desired voltage transformation module duty cycle known and old in the art, such as greater than 90%, since this is part and parcel of the normal process of making a specific power supply for a specific purpose.

Applicant respectfully disagrees. Claim 33 depends from and incorporates the features of independent claim 22 discussed above and is therefore patentable for at least the same reasons.

11. Claims 38 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Steigerwald et al.

Steigerwald et al. teaches a voltage transformation module using an output current feedback signal as recited by claims 38 and 39 except for controlling the voltage transformation module using an output current feedback signal. Controlling the voltage transformation module using an output current feedback signal was an old and known expedient in the art at the time of the invention. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the power distributing apparatus of Steigerwald et al. by controlling the voltage transformation module using an output current feedback signal in order to provide regulation of the output in a desired manner old and known in the art.

Applicant respectfully disagrees. Claims 38 and 39 depend from and incorporates the features of independent claim 19 discussed above and are therefore patentable for at least the same reasons.

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Rogowsky (US 4,459,492), Dreifuerst et al. (US 5,434,770), Yashiro (US 5,530,635), Ikeshita (US 5,631,813), Takahashi et al. (US 5,768,117), Kociecki (US 6,198,642), and Dinh et al. (US 6,650,556) are cited to show voltage transformation module old and known in the art at the time of the invention.

The above references were not discussed because they were not applied to the claims.

All other claims depend from and incorporate the features of the independent claims discussed above and are therefore patentable for at least the same reasons.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

Applicant respectfully requests consideration of the references identified in the Information Disclosure Statement filed with this response and return of the initialed Form PTO-1449.

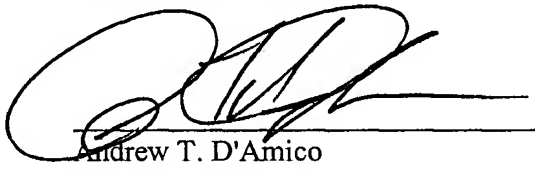
Applicant asks that all claims be allowed.

The examiner is invited to call the undersigned attorney with any questions or comments or any other matter that will help advance prosecution of this case.

Enclosed is a $4,820.00 check for excess claim fees and the Petition for Three Month Extension of Time fee. Please apply any other charges or credits to deposit account 06-1050, referencing Attorney Docket No. 00614-136002.

Respectfully submitted,

Date: Feb. 10, 2005



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